

Remarks/Arguments:

By this amendment, applicant has amended claims 1, 4, and 5 and cancelled claim 8. Claims 1-7 and 9-22 are pending.

Applicant's amendments to the claims are provided strictly for clarity purposes.

Allowable and Allowed Subject Matter

Applicant acknowledges with appreciation the Examiner's finding that claims 7 and 17 are allowable, and that claims 9-13 and 18-22 are allowed. As noted below, applicant has cancelled claim 8. Therefore, claims 7 and 17 should be found allowed.

Double Patenting

Claim 8 is objected to under 37 C.F.R. 1.75 as being substantially a duplicate of claim 7. Applicant has cancelled claim 8 to overcome the basis for this objection.

Claim Rejections Under Section 103

Claims 1, 5, 14, and 16 stand rejected under 35 U.S.C. Section 103(a) as being unpatentable over Kuriyama in view of Kojima. By this Amendment, applicant respectfully traverses this Section 103(a) rejection.

Claims 1 and 5 are independent claims. Claims 2, 3, and 14 are dependent on claim 1, and claims 6 and 16 are dependent on claim 5.

Turning first to claim 1, it is directed to a field emission type electron source device including the following elements:

- a field emission electron source portion including an extraction electrode provided on a p-type silicon substrate via an insulating film and having an opening portion at a position corresponding to region where a cathode is provided, and a cathode

portion provided on the p-type silicon substrate and at a position corresponding to the opening portion of the extraction electrode; and

- an n-channel field effect transistor portion provided on the p-type silicon substrate corresponding to the field emission electron source portion, wherein:
- the field emission electron source portion is provided in a drain region of the field effect transistor portion, and a control voltage is applied to a gate electrode of the field effect transistor portion to control a field emission current from the field emission electron source portion,
- **the drain region** includes different impurity elements and includes at least two wells having different impurity concentrations **having symmetrical impurity distributions**, and
- of the at least two wells, **one well having a low impurity concentration is provided around a circumference of the other well having a higher impurity concentration.**

Applicant submits that claims 1 is patentably distinguished from the Kuriyama and Kojima Patents for at least two reasons. First, the requirement that the drain region includes different impurity elements and includes at least two wells having different impurity concentrations having symmetrical impurity distributions (hereinafter referred to as "Symmetrical Impurity Distribution Feature") is neither taught nor suggested in any of the references of record. Secondly, one skilled in the art would not consider applying the teaching of the Kojima Patent to the Kuriyama Patent in order to achieve the feature of claim 1 of one well having a low impurity concentration provided around the circumference of the other well having a higher impurity concentration (hereinafter referred to as the "Circumference Feature").

An advantage of the Symmetrical Impurity Distribution Feature is that it allows for a gradual pn junction at the drain end, resulting in relaxation of the concentration of the field at the drain end. This also removes the factor of hot electrons degrading the FET performance, securing extremely stable device operation for an extended period of time, and improving

device reliability. This advantage of the Symmetrical Impurity Distribution Feature can be found throughout the originally filed specification, for example at page 25, lines 9-14.

Applicant respectfully submits that the Office Action does not so much as consider the Symmetrical Impurity Distribution Feature of applicant's claimed invention. It is applicant's contention that this feature is not taught in the Kuriyama Patent and is not taught in the Kojima Patent. The Kojima Patent is completely silent as to whether impurity concentrations of drain regions have Symmetrical Impurity Distributions. Thus on the basis of the Symmetrical Impurity Distribution Feature, claim 1 and the claims dependent thereon are patentably distinguished from the Kuriyama and the Kojima Patents. But there are further reasons for patentably distinguishing applicant's claim 1 from the Kuriyama and Kojima Patents.

With respect to the Circumference Feature, the Examiner admits that this feature is not taught in the Kuriyama Patent, but relies on the Kojima Patent to rectify this deficiency of the Kuriyama Patent. The Kojima Patent in general relates to an integrated circuit type semiconductor device consisting of all MISFETs, and has high rated voltage characteristics based on a gate insulation film structure of a thin film. Applicant notes, however, that the Kojima Patent discloses with respect to Figure 15 a lightly doped drain region 162 that surrounds the heavily doped drain region 103 to further increase the rated voltage of the drain. (See column 11, lines 65-67 of the Kojima Patent). Applicant further notes that the Kojima Patent is directed toward an inverter circuit in which a lightly doped region is provided to further increase the rated voltage of the drain. The results which Kojima is seeking (that is the purpose of the Kojima Patent) is entirely different than that of applicant's claimed invention which is a gradual pn junction at the drain end, as discussed above. In other words, the purpose of the Kojima Patent, as well as the Kuriyama Patent, is different from that of applicant's claimed invention. Applicant contends that because the purpose of applicant's claimed invention is different from that of the Kuriyama and Kojima Patents, and further because the purpose of the Kuriyama and Kojima Patents is different from one another, one skilled in the art would not find the requisite motivation to modify the structure of the Kuriyama Patent with the teaching of the Kojima Patent in order to achieve applicant's claimed invention.

It is black letter law that the Examiner has the burden to establish an obviousness rejection. In rejecting claims under Section 103, the Examiner bears the initial burden of

presenting a *prima facie* case of obviousness. If the Examiner fails to establish a *prima facie* case, the rejection is improper and will be overturned. *In re Rijckaert* 9F.3d 1531, 1532 (Fed. Cir. 1993). Obviousness cannot be established by combining the teachings of the cited references to produce the claimed invention, absent some suggestion or incentive supporting the combination. *In re Bond*, 910 F.2d 831, 834 (Fed. Cir. 1990). Simply put, there is no requisite motivation in the teachings of the Kuriyama and Kojima Patents in order to achieve the Circumference Feature because the purpose of these references is not the same for each other, and is likewise not the same with respect to applicant's claimed invention. It is applicant's contention that the rejection of claim 1 relative to the Circumference Feature is nothing more than hindsight reconstruction of applicant's claimed invention with is improper.

Based on the foregoing, applicant's request that the section 103 rejection directed to claim 1 and 14 based on the Kuriyama and Kojima Patents be withdrawn.

Turning now to independent claim 5, it includes among its features the following:

the gate insulating film is a film thinner than the first insulating film, the first insulating film being provided between the extraction electrode and the p-type silicon substrate, and the gate electrode is buried with the first insulating film.

Applicant has amended this feature of claim 5 to more clearly define applicant's claimed invention. This amendment to claim 5 is not the addition of new matter but is based on the application as originally filed, and in this connection applicant directs the Examiner's attention to page 35, lines 9-10 and lines 29-30.

The advantage of the above recited feature of claim 5 is that the gate insulating film (lower insulating film) needs good quality and must be thin. However, both the gate insulating film and the adjacent first insulating film must be used in combination as a multilayer, thick insulating film, to insulate the extraction electrode to which a high voltage (of several tens of volts) is typically applied. (See page 35, lines 9-21 of the subject application). The amendment to the above noted feature of claim 5 clearly indicates that two separate insulating films are used in the field emission type electron source device, and both have a separate

function. This feature of the two insulating films is simply not found or suggested in the Kuriyama and Kojima Patents.

In particular, applicant notes that the Kuriyama Patent discloses only a single insulator layer 3. Thus the insulator layer of Kuriyama is not structurally and is not functionally the same as the above identified feature of applicant's claimed invention. Since this feature is lacking in both the Kuriyama and Kojima Patents, applicant respectfully submits that claim 5 and dependent claim 16 are patentably distinguished from the Kuriyama and the Kojima Patents.

Based on the foregoing discussion, applicant requests that the Section 103 rejection directed to claims 1, 5, 14 and 16 be withdrawn.

Claims 2 and 3 stand rejected under 35 U.S.C. Section 103(a) as being unpatentable over Kuriyama and Kojima and further in view of Akamatsu. Applicant respectfully traverses this Section 103(a) rejection.

Claims 2 and 3 are dependent on claim 1 and therefore are patentably distinguished from the Kuriyama and Kojima Patents for the reasons noted above. It is applicant's further contention that the Akamatsu Patent does not rectify the deficiencies theretofore discussed with respect to the Kuriyama and Kojima Patents.

The Akamatsu Patent in general relates to a semiconductor device where an FET and an insulation are provided on a semiconductor substrate, and a channel stop region is provided under the insulation. More specifically, the Akamatsu Patent has been cited with respect to the thermal diffusion of phosphorus and arsenic. But nowhere in the Akamatsu Patent is there any teaching or suggestion of the Symmetrical Impurity Distribution Feature or the Circumference Feature of applicant's claim 1. Thus, the Akamatsu Patent does not rectify the deficiencies heretofore discussed with respect to the Kuriyama and Kojima Patents. On that basis, applicant requests that the Section 103 rejection directed to claims 2 and 3 be withdrawn.

Claims 4 and 15 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Kuriyama in view of Kojima and Kawaguchi. Applicant respectfully traverse this Section 103(a) rejection.

Claim 4 is an independent claim with claim 15 dependent thereon. Claim 4 is directed to a field emission type electron source device and includes the following elements:

- a field emission electron source portion including an extraction electrode provided on a p-type silicon substrate via an insulating film and having an opening portion at a position corresponding to a region where a cathode is provided and a cathode portion provided on the p-type silicon substrate and at a position corresponding to the opening portion of the extraction electrode; and
- an n-channel field effect transistor portion provided on the p-type silicon substrate, corresponding to the field emission electron source portion, wherein:
- the field emission electron source portion is provided in drain region of the field effect transistor portion, and a control voltage is applied to a gate electrode of the field effect transistor portion to control a field emission current from the field emission electron source portion;
- the gate electrode of the field effect transistor portion has shape such that a portion of the gate electrode nearer the drain region has total width wider than a total width of a portion of the source electrode nearer the source region, **and a part of the gate electrode is provided in such a manner as to cover an end of the drain region.**

It is applicant's contention that the gate electrode as defined in applicant's claim 4 where a part of the gate electrode is provided in such a manner as to cover an end of the drain electrode (hereinafter referred to as the "Gate Electrode Feature") is neither taught nor suggested in any of the references of record.

Applicant has amended claim 4 to more clearly set forth this feature of the applicant's claimed invention. The advantage of the Gate Electrode Feature is that electrons injected from the source of the FET move along the channel formed under the gate electrode, and thus the electron flow path is enlarged in the small n-channel field effect transistor portion, and drain current density is more significantly reduced in the drain end region of the gate electrode.

Thus, degradation of the FET's performance due to hot electrons is significantly reduced. In this connection, applicant directs the Examiner's attention to page 30, lines 8-21 of the subject application.

The Office Action readily admits at page 9 that the Kuriyama Patent does not teach "that the gate electrode of the field effect transistor portion has a shape such that a portion of the gate electrode nearer the drain region has a total width wider than a total width of a portion of near the source region". But the Office Action does not go on to discuss the further requirement of claim 4; namely, that a part of the gate electrode is provided in such a manner as to cover an end of the drain region, i.e. Gate Electrode Feature. Simply put, the Gate Electrode Feature is not dealt with in the Office Action. Nonetheless, applicant submits that the Gate Electrode Feature is not taught nor suggested in the Kuriyama Patent, the Kojima Patent or the Kawaguchi Reference.

The Kawaguchi Reference has been cited with respect to the gate 1, but nowhere in the Kawaguchi Patent is there any teaching or suggestion of the Gate Electrode Feature of claim 4 as noted above. Thus the combination of the Kuriyama Patent, Kojima Patent, and Kawaguchi Reference would not teach one skilled in the art the field emission type electrode source device defined in applicant's claim 4. Accordingly, applicant requests the Section 103(a) rejection directed to claim 4, and dependent claim 15 be withdrawn.

Claim 6 stands rejected under 35 U.S.C. 1103(a) as being unpatentable over Kuriyama and Kojima and further in view of Hirano. Applicant respectfully traverse this Section 103(a) rejection.

Claim 6 is dependent on claim 5 and therefore includes the feature of the gate insulating film being a film thinner than the first insulating film, with the first insulating film being provided between the extraction electrode and the p-type silicon substrate, and the gate electrode being buried with the first insulating film. As noted above, this feature is neither taught nor suggested in the Kuriyama and Kojima Patents. It is applicant's contention that the Hirano Reference (which has been cited with respect to thermal oxidation of silicon) simply does not rectify the deficiencies heretofore discussed with respect to the Kuriyama and Kojima Patents relative to claim 5. Thus, it is applicant's contention that dependent claim 6 is

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patentably distinguished from the Kuriyama and Kojima Patents, and the Hirano Reference, which requires the withdraw of the Section 103(a) rejection.

Based on the foregoing marks and amendments, applicant respectfully submits that claims 1-6 and 14-16 are in condition for allowance, and that claims 7, 9-13 and 17-22 are either allowed or allowable. Reconsideration and allowance of all pending claims are respectfully requested.

Respectfully submitted,

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